Claims

[c1] 1.A method for transporting a plurality of client data signals via a single server signal comprising:

mapping client payload data from a plurality of input client data signals to a payload of a server signal;

mapping client overhead data from the plurality of input client data signals to a first portion of unused overhead data in the server signal;

mapping client timing data from the plurality of input client data signals to a second portion of unused overhead data in the server signal;

transporting the server signal;

extracting the client payload data, client overhead data and client timing data from the server signal; and

constructing a plurality of output client data signals from the client payload data, client overhead data and client timing data.

[c2] 2.The method of claim 1 wherein constructing the plurality of output client data signals comprises constructing output client data signals which have bit sequences and timing that are substantially identical to the plurality of input client data signals.

[c3] 3.The method of claim 2 further comprising generating the timing data for each of the plurality of input client data signals and constructing the corresponding output client data signals.

[c4] 4.The method of claim 3 wherein generating the client timing data for each of the plurality of input client data signals comprises, for each input client data signal, counting the bits of the input client data signal and determining the number of bits of the input client data signal which are counted in a predetermined interval, and wherein constructing the corresponding output client data signals comprises, for each output client data signal, counting the bits of the output client data signal, determining the number of bits of the output client data signal which are counted in the predetermined interval and adjusting a data rate of the output client data signal to cause the number of bits

of the output client data signal which are counted in the predetermined interval to match the number of bits of the input client data signal which are counted in the predetermined interval.

[c5] 5.The method of claim 1 wherein transporting the server signal comprises transmitting the server signal over a high-bit-rate server span.

[c6] 6.The method of claim 1 wherein the input client data signals, output client data signals and server signal comprise SONET signals.

[c7] 7.The method of claim 6 wherein the input client data signals and output client data signals comprise OC-48 SONET signals and the server signal comprises an OC-192 SONET signal.

[c8] 8.The method of claim 1 further comprising generating the client timing data for each of the plurality of input client data signals.

[c9] 9.The method of claim 8 wherein generating the client timing data for each of the plurality of input client data signals comprises, for each input client data signal, counting the bits of the input client data signal and determining the number of bits which are counted in a predetermined interval.

[c10] 10.A method for transporting a plurality of low-bit-rate data signals over a high-bit-rate data line comprising:
encapsulating a payload portion of a plurality of low-bit-rate data signals within a payload portion of a high-bit-rate data signal;
inserting timing information associated with the low-bit-rate data signals within an overhead portion of the high-bit-rate data signal;
transporting the high-bit-rate data signal over a high-bit-rate data line;
extracting the payload portion of the low-bit-rate data signals and the timing information associated with the low-bit-rate data signals from the payload portion of a high-bit-rate data signal; and
reconstructing the low-bit-rate data signals from the payload portion of the low-bit-rate data signals and the timing information associated with the low-bit-rate data signals.

[c11] 11.The method of claim 10 wherein reconstructing the plurality of low-bit-rate data signals from the high-bit-rate data signal comprises reproducing the bit sequence and timing of at least one of the plurality of low-bit-rate data signals.

[c12] 12.A system for transporting a plurality of low-bit-rate data signals over a high-bit-rate data line comprising:
a multiplexer configured to receive a plurality of low-bit-rate input data signals and configured to combine the low-bit-rate data signals into a single high-bit-rate data signal;
a transmission medium coupled to the multiplexer and configured to transport the high-bit-rate data signal; and
a demultiplexer coupled to the transmission medium and configured to generate a plurality of low-bit-rate output data signals from the high-bit-rate data signal.

[c13] 13.The system of claim 12 wherein the multiplexer is configured to map a payload of each low-bit-rate input data signal to a payload of the high-bit-rate data signal, to map overhead data of each low-bit-rate input data signal to unused overhead of the high-bit-rate data signal, and to map timing data for each low-bit-rate input data signal to the unused overhead of the high-bit-rate data signal.

[c14] 14.The system of claim 13 wherein the demultiplexer is configured to extract the payload for each low-bit-rate output data signal from the payload of the high-bit-rate data signal, to extract the overhead data for each low-bit-rate output data signal from the overhead of the high-bit-rate data signal, and to extract the timing data for each low-bit-rate output data signal from the overhead of the high-bit-rate data signal.

[c15] 15.The system of claim 14 wherein the demultiplexer comprises one or more egress modules configured to generate each low-bit-rate input data signal according to the corresponding timing data.

[c16] 16.The system of claim 15 wherein each of the egress modules comprises an

egress buffer configured to store the second data stream, a phase locked loop (PLL) configured to control a rate at which data is read out of the egress buffer to produce the third data stream, an egress counter configured to count bits of the third data stream, and timing logic coupled to the egress counter and the egress timer and configured to determine a data rate of the third data stream and to control the PLL to match the data rate of the third data stream to a data rate of the first data stream.

[c17] 17.The system of claim 16 wherein the timing logic is configured to determine a difference between the data rate of the first data stream and the data rate of the third data stream, and wherein the timing logic is configured to increase the frequency of the PLL if the data rate of the first data stream is greater than the data rate of the third data stream and to decrease the frequency of the PLL if the data rate of the first data stream is less than the data rate of the third data stream.

[c18] 18.The system of claim 16 wherein each of the egress modules further comprises a converter configured to convert an electrical signal into an optical output signal.

[c19] 19.The system of claim 12 wherein the multiplexer comprises one or more ingress modules configured to generate the timing data for each low-bit-rate input data signal.

[c20] 20.The system of claim 19 wherein each of the ingress modules comprises an ingress buffer configured to store the first data stream, an ingress counter configured to count the bits of the first data stream which are stored in the ingress buffer, an ingress timer, and write logic coupled to the ingress counter and the ingress timer and configured to determine the data rate of the first data stream, wherein the write logic is further configured to periodically write the data rate of the first data stream into the ingress buffer.

[c21] 21.The system of claim 20 wherein each of the ingress modules further comprises a converter configured to convert a received optical signal into an

electrical signal.

[c22] 22.The system of claim 19 wherein each of the ingress modules is configured to generate the timing data by counting a number of received bits in a predetermined interval.

[c23] 23.The system of claim 12 wherein the demultiplexer is configured to generate the plurality of low-bit-rate output data signals by reconstructing the bit sequence and timing of at least one of the low-bit-rate input data signals in a corresponding one of the low-bit-rate output data signals.

[c24] 24.The system of claim 12 wherein the demultiplexer is configured to generate the plurality of low-bit-rate output data signals by generating at least one of the low-bit-rate output data signals corresponding to one of the low-bit-rate input data signals such that a payload of the at least one of the low-bit-rate output data signals is the same as a payload of the corresponding one of the low-bit-rate input data signals, and overhead data of the at least one of the low-bit-rate output data signals is different from overhead data of the corresponding one of the low-bit-rate input data signals.

[c25] 25.The system of claim 12 wherein the demultiplexer is configured to generate a first low-bit-rate output data signal by reconstructing the bit sequence and timing of a corresponding one of the low-bit-rate input data signals in the first low-bit-rate output data signal and to generate a second low-bit-rate output data signal having an identical payload and different overhead data from a corresponding low-bit-rate input data signal.

[c26] 26.The system of claim 12 wherein the multiplexer is configured to map overhead data of each low-bit-rate input data signal to an unused portion of overhead of the high-bit-rate data signal and to map timing data for each low-bit-rate input data signal to the unused overhead of the high-bit-rate data signal.

[c27] 27.The system of claim 12 wherein the transmission medium comprises an optical transmission network, wherein the multiplexer is configured to generate

the high-bit-rate data signal in an optical form, and wherein the multiplexer is configured to receive the high-bit-rate data signal in an optical form.

[c28] 28.The system of claim 27 wherein the transmission medium comprises a SONET network.

[c29] 29.The system of claim 12 wherein the transmission medium comprises an electrical transmission network.

[c30] 30.A system for transporting a plurality of low-bit-rate data signals over a high-bit-rate data line comprising:

a multiplexer configured to map a payload of each low-bit-rate input data signal to a payload of a high-bit-rate data signal, to map overhead data of each low-bit-rate input data signal to unused overhead of the high-bit-rate data signal, and to map timing data for each low-bit-rate input data signal to the unused overhead of the high-bit-rate data signal;

a transmission medium coupled to the multiplexer and configured to transport the high-bit-rate data signal; and

a demultiplexer coupled to the transmission medium, wherein the demultiplexer is configured to extract the payload, overhead data and timing data corresponding to each low-bit-rate input data signal from the high-bit-rate data signal and to generate a plurality of low-bit-rate output data signals which are substantially identical to the corresponding low-bit-rate input data signals.

[c31] 31.The system of claim 30 wherein the transmission medium comprises an optical transmission network, wherein the multiplexer is configured to generate the high-bit-rate data signal in an optical form, and wherein the multiplexer is configured to receive the high-bit-rate data signal in an optical form.

[c32] 32.The system of claim 31 wherein the transmission medium comprises a SONET network.

[c33] 33.The system of claim 30 wherein the transmission medium comprises an electrical transmission network.